Claims

1. Method for reconstructing multidimensional objects from one- or two-dimensional image data, especially from ultrasound image data, by means of recordings (7) of one- or two-dimensional partial image areas (6) of the object (1), wherein the absolute positions of the individual partial image areas (6) in space and/or the relative positions of the individual partial image areas (6) to each other are used along with the one- or two-dimensional image information (13) of the individual partial image areas (6) for generating one- or two-dimensional image data,
   characterized in
   that a first group of space elements (15a) is generated in a multidimensional voxel space (9) from first space elements (10a) which contain multidimensional image information and touch or intersect planes or lines of the partial image areas (6) by means of one- or two-dimensional image data, and
   that a second group of space elements (15b) is generated in the multidimensional voxel space (9) from second space elements (10b) by means of an information transformation from the multidimensional image information of the first group of space elements (15a).

2. Method according to claim 1,
   characterized in
   that the multidimensional image information of each first space element (10) is determined by means of that one- or two-dimensional image information (13) which exists at

the particular interface/point of contact of the respective first space element (10a) with the respective plane or line of a partial image area (6).

3. Method according to anyone of claims 1 or 2,
characterized in
that the spatial and/or chronological distance (x) from each second space element (10b) to the next first space element (10a) of the first group of space elements (15a) is determined, and
that the multidimensional image information of each second space element (10b) is determined by means of the multidimensional image information of the spatially and/or chronologically nearest first space element (10a).

4. Method according to claim 3,
characterized in
that the multidimensional image information of each second space element (10b) will not be determined when the spatial and/or chronological distance (x) to the nearest first space element (10a) is larger than a pre-determinable maximum spatial and/or chronological distance (x_{max} or t_{max}).

5. Method according to anyone of claims 3 or 4,
characterized in
that the multidimensional image information of the spatially and/or chronologically nearest first space element (10a) is used as multidimensional image information of each second space element (10b) lying within the maximum spatial and/or chronological distance (x_{max} or t_{max}) to a

first space element (10a).

6. Method according to anyone of claims 3 - 5,
characterized in
that the spatial and/or chronological distance (x,t) and a reference number for the plane or line of the partial image area (6), which was used to determine the multidimensional image information of the nearest first space element (10a), is also stored as multidimensional image information of each second space element (10b).

7. Method according to anyone of claims 1 or 2,
characterized in
that the spatial and/or chronological distances (x_i, t_i) from each second space element (10b) to two or more first space elements (10a) of the first group of space elements (15a) are determined, and
that the multidimensional image information of each second space element (10b) is determined by means of the multidimensional image information of a pre-determinable number of spatially and/or chronologically nearest first space elements (10a).

8. Method according to claim 7,
characterized in
that the multidimensional image information of each second space element (10b) is determined by means of the multidimensional image information, weighted on the basis of the different spatial and/or chronological distances (x_i, t_i), of a pre-determinable number of first space elements (10a).

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9. Method according to anyone of claims 1 or 2,
characterized in
that a search beam (14) runs from each first space element (10a) along a pre-determinable multidimensional direction vector (Φ) and defines those second space elements (10b) which are determined by means of the multidimensional image information of that first space element (10a) which forms the starting point (16) of the search beam (14).

10. Method according to claim 9,
characterized in
that the search beam (14) has its chronological and/or spatial starting point (16) on the plane or line of the partial image area (6) which was used to determine the multidimensional image information of the first space element (10a), and
that the search beam (14) has a maximum spatial and/or chronological length (11) along the pre-determinable multidimensional direction vector (Φ).

11. Method according to anyone of claims 9 or 10,
characterized in
that the second space elements (10b) are also determined by means of the multidimensional image information of another first space element (10a) of the first group of space elements (15a), which constitutes a target point (19) which is hit by the search beam (14).

12. Method according to claim 11,
characterized in that
the second space elements (10b) are determined by means

of the weighted multidimensional image information of the starting point (16) and the target point (19), wherein the weights orientate themselves at the multidimensional distances of each second space element (10b), lying on the search beam (14), to the starting or target point (16, 19).

13. Method according to anyone of claims 9 to 10,
characterized in
that the second space elements (10b) are determined in a first step by means of the multidimensional image information of that first space element (10a) which forms the starting point (16) of the search beam (14), and
that the second space elements (10b) are weighted in further steps by means of multidimensional image information of further first space elements (10a) which form starting points (16) of search beams (14) which also penetrate the second space elements (10b), wherein the weights orientate themselves at the multidimensional distances of each second space element (10b) to the respective starting points (16, 19).

14. Method according to anyone of the preceding claims,
characterized in
that the object (1) is reconstructed and represented multidimensionally by means of the multidimensional voxel space (9) consisting of the first and second group of space element (15a, 15b), and/or
that parts of the reconstructed object (17) are represented by means of variable sectional planes (18).

15. Method according to claim 14,
characterized in
that the reconstructed object (17) or parts thereof will be represented or equipped with pre-determinable characteristics like colour or resistance.

16. Method according to anyone of claims 14 or 15,
characterized in
that certain parts of the multidimensional voxel space (9) are marked and sampled for representation on one side of an intersectional plane (18) in order to visualize certain parts of the reconstructed object (17).

17. Method according to anyone of claims 14 - 16,
characterized in
that the multidimensional voxel space (9) is sampled by means of an intersectional plane (18) into at least two halves (9a, 9b) to visualize certain parts of the reconstructed object (17), and
that the intersectional plane and/or the at least two halves (9a, 9b) are pivotable/rotatable and/or displaceable in different multidimensional directions.

18. Device for reconstructing multidimensional objects from one- or two-dimensional image data, particularly from ultrasound image data, on the basis of recordings (7) of one- or two-dimensional partial image areas (6) of the object (1),
wherein first storage means store the absolute spatial and/or chronological positions of the individual partial image areas (6) and/or the relative spatial and/or chronological positions of the individual partial image

areas (6) to each other along with the one- or two-dimensional image information (13) of the individual partial image areas (6) for generating one- or two-dimensional image data,

characterized in

that second storage means store a first group of space elements (15a) which can be generated in a multidimensional voxel space (9) from first multidimensional image information containing space elements (10a) which touch or intersect planes or lines of partial image areas (6) by means of the one- or two-dimensional image data, and

that third storage means store a second group of space elements (15b) which can be generated in the multidimensional voxel space (9) from second space elements (10b) by means of an information transformation from the multidimensional image information of the first group of space elements (15a).

19. Device according to claim 18,

characterized in

that the object (1) can be reconstructed and represented by means of a display by spanning the multidimensional voxel space (9) by means of the first and second group of space elements (15a, 15b).

20. Device according to anyone of claims 18 or 19,

characterized in

that calculation means carry out the information transformation from the data of the first and second storage means and store the results in the third storage means.

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21. Use of a method according to anyone of claims 1 to 17 or a device according to anyone of claims 18 to 20 for the multidimensional reconstruction and representation of an organ, especially the heart of a creature, considering the motion of the heart.

22. Use of a method according to anyone of claims 1 to 17 or a device according to anyone of claims 18 to 20 for the transthoracal (TTE), transoesophagic (TEE) or intravascular (IVUS) echocardiography or intraductal (IDUS) sonography.

Für die Übereinstimmung der vorstehenden Wiedergabe mit dem Original
29. Juli 2004
Patentanwalt